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Measuring R&D in the Services

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Measuring R&D in the Services

Alison Young

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Measuring R&D in the Services
Alison Young*

The aim of this paper is to identify the main problems of comparison between countries and over time of the data on R&D performed in the services industries collected by Member countries and reported to OECD, given the recent rapid growth in their share of total R&D expenditures in the business enterprise sector.

The degree to which national R&D surveys cover the service industries varies considerably. Some have made substantial efforts to extend this coverage recently in response both to national policy needs and to the implementation the revised OECD R&D questionnaire, notably concerning the computer services industry/software R&D. The coverage and classification of special R&D institutes continues to vary between countries. The coverage and quality of the data is clearly improving but considerable further progress will be needed before the R&D statistics for service industries can be used for integrated economic studies.

Despite these variations in coverage, the data already reveal something about the R&D efforts of the services as a whole and of the three "S&T intensive" service industries: R&D services; computer services and communications. Some interesting evidence is also emerging about R&D in what were hitherto taken to be the "non-S&T based" services.

Ce papier a pour objectif de recenser les principaux problèmes de comparaison entre pays et dans le temps lies aux données de recherche -- développement (R-D) dans le secteur des services recueillies par les pays Membres et communiquées à l'OCDE, étant donné leur poids croissent dans l'ensemble des dépenses de R-D du secteur des entreprises.

La prise en considération de l'industrie des services dans les enquêtes nationales sur la R-D est extrêmement variable. Certains pays ont fait récemment des efforts considérables pour élargir le champ couvert, notamment dans le domaine de la R-D liée aux logiciels et aux activités informatiques, afin de répondre aux besoins des décideurs nationaux et de tenir compte de l'introduction du questionnaire révisé de l'OCDE. La prise en compte et la classification des instituts de R-D spécialisés continuent à varier d'un pays à l'autre. Le champ couvert par les données et leur qualité s'améliorent notablement, mais de nouveaux progrès importants restent à faire avant de pouvoir utiliser les statistiques de R-D dans les services dans des analyses économiques intégrées.

Malgré ces variations dans les champs couverts par les données, celles-ci fournissent déjà certain renseignements sur les efforts de R-D de tris activités de services "à forte intensité de science et de technologie" : les services de R-D, les activités informatiques et les communications. On commence également à disposer d'informations intéressantes concernant la R-D dans ce qui était considéré jusqu'ici comme les services "non basés sur la science et la technologie".

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I. Introduction

Aim of the paper

The service industries now make a large contribution to the economies of OECD Member countries (Table 1). So far they have been thought of mainly as importing technology from manufacturing industries embedded in capital equipment, notably computers. For example a recent OECD study (Papaconstantinou *et al*, 1996) showed that the four main user industries of such embodied technology in the United States were: social and personal services; wholesale and retail trade; real estate and business services; and transport and storage and that the same industries were in the top five users for most of the other countries included. That exercise, was based on the assumption that the service industry had no role as producers of technology. This was not realistic in that the services include a number of industries whose main economic activity is technology supply (commercial R&D firms, software houses etc.) and that even for industries where change is initially brought about by embodied technology, this subsequently leads firms to carry out independent R&D. The aim of this paper is to examine the R&D data available at the OECD to see whether the services are developing such efforts and to review the problems of interpretation caused by international differences in the coverage of the data and by changes in survey practice over time.

OECD surveys and databases on industrial R&D

OECD has been holding surveys of resources devoted to R&D in Member countries for thirty years with the first survey held in respect of 1963. The questionnaires for these surveys are based on the latest version of the OECD standard practice known as the Frascati Manual (OECD; 1994) available at the time concerned. All the surveys have included tables on R&D expenditure and personnel broken down by industry.

From the outset the industrial classification used was designed to identify those industries which were particularly heavy performers of R&D and was originally based on one first established by the National Science Foundation in the United States around 1960. Since there was little thought of comparing R&D and regular industrial statistics, compatibility with the Standard UN classification of Economic Activities (ISIC) was not given much priority. Categories were identified as needed for S&T studies and were then described in terms of ISIC, sometimes with difficulty, as the UN classification did not always identify R&D intensive industries (for example, in ISIC Rev. 2 computers were included in non-electrical machinery because they were office machines). During the preparation of the latest version of the Frascati Manual it was decided to adopt a classification activity based directly on ISIC Rev.3/NACE Rev. 1 which was first used in the OECD R&D survey for reference year 1991 (See technical annex).

Services R&D in OECD data-bases

The new R&D questionnaire differs significantly from the old one regarding the services. In the old version “utilities” and “construction” were included in the services subtotal whereas they are excluded in the new one. More detail on the remaining service industries is now requested (box 2). A further problem is that the two classifications cannot be matched precisely. The old category “commercial and engineering services” did not correspond to an ISIC Rev. 2 category but had been specially established to identify “S&T supply” service units notably those specialising in R&D. In the new classification most but not all of this category belongs in “R&D” and the rest probably in “other business activities”.

Box 1. Breakdown of services in OECD R&D questionnaires

<table>
<tr><td>Old classification

(ISIC Rev 2)</td><td>New classification

(ISIC Rev 3 NACE Rev 1)</td></tr>
<tr><td>Transport and storage</td><td>Transport and Storage</td></tr>
<tr><td>Communications</td><td>Communications</td></tr>
<tr><td></td><td rowspan="4">Real estate, renting and business activities(1)

Computer services

R& D
Other business services
Financial intermediation
Wholesale and retail
Hotels and restaurants
Community and personal services</td></tr>
<tr><td>Commercial & Engineering</td></tr>
<tr><td>Other services</td></tr>
</table>

(1) referred to hereafter as business services
Source: Technical Annex Tables A-1 and A-2

Countries responded very differently to the change in classification and a request for backdating; from supplying a full revised set of data as in Canada to making no changes at all as in Japan and Germany. The usual immediate response was to revise existing data by breaking out the "R&D" share from "commercial and engineering services" and by separating out "computer services" R&D where this was already included in the survey, often leaving a significant share of services R&D undistributed between the new categories. Actual changes in the underlying national surveys followed slightly later. In brief the coverage and classification of the data are in a period of flux.

In 1995 a special questionnaire was sent to Member countries to find out more about treatment of the services in national R&D surveys and how this had changed over time. In the end twenty-four countries took part[1]. This paper draws heavily on the results of this exercise.

II. International comparisons of total R&D in the service industries

Differences in the amount of services R&D reported by countries may be caused by real differences in the quantity of R&D performed, in variations in how far it is covered by national R&D in surveys, and, if included, by variations in the industry in which it is classified.

[1] Austria, Iceland, Portugal and the United States responded in July 1996 when this paper was largely completed. The responses have been included as far as possible.

Share of services in total industrial R&D

Services R&D is no longer negligible. In seven OECD countries one quarter or more of all R&D expenditure in the Business Enterprise sector (BERD) is carried out in the services industries (Table 2). They are in descending order: Norway; New Zealand; Greece; Denmark; Australia; Canada and the United States. The share is also above 15 per cent of BERD in Portugal, the United Kingdom, Iceland and Spain. (These countries will be referred to as "high services R&D spenders").

However about one third of the OECD countries report little R&D outside manufacturing. R&D in the services is less than 10 per cent of BERD and other non-manufacturing R&D (agriculture, mining, construction, utilities) represents under five per cent of BERD. These countries are: Japan; Germany; Austria; Sweden; Belgium; France; Turkey and Mexico (probably. (These countries will be referred to as "low services R&D spenders). Finland, Ireland, Italy the Netherlands and Switzerland[2] are in an intermediate position with about ten per cent of BERD performed in the services.

Effect of industrial structure

These differences might simply reflect variations in the economic importance of the services industries. At first sight industrial structure is not an important factor in fixing the level of R&D reported for the service industries. Figure 1, which compares the percentage of total industrial value added generated by the service industries (see technical annex) with the percentage of BERD performed by the service industries, shows little or no relationship between the two with much greater variation in the R&D shares. This can be viewed a different way by comparing R&D spending data with value added for the service industries. The resulting figure will be referred to as the "apparent R&D intensity" as in many cases it tells us as much about the data used as about the actual situation in the industries concerned.

A comparison between the apparent R&D intensity and the share of BERD (figure 2) show that the "high service R&D spenders" are of two kinds, those where R&D spending is also a relatively high percentage of value added (over 0.4 per cent) i.e. Norway, United States, Denmark, United Kingdom, Canada and Australia plus Finland and those where it is a low one (under 0.2 per cent) i.e. New Zealand, Greece Spain, Iceland and Portugal. The low services R&D spenders all have apparent R&D intensities of under 0.3 per cent.

To some extent this merely reflects the general level of industrial R&D intensity in the countries concerned. Figure 3 compares the apparent R&D intensities of the services and of manufacturing with the latter as might be expected always the higher of the two. The low intensity/high share countries (Greece, Iceland, New Zealand, Portugal and Spain) are all grouped in the bottom left hand corner. If we assume, for the moment a complementary relationship between the two indicators and run an imaginary diagonal out to the United States we see two sets of outliers, Norway and Denmark with higher than expected services R&D intensities and a larger group comprising Austria, Belgium, the Netherlands, France, Germany, Japan and Sweden with low apparent R&D intensities for the service industries given their manufacturing R&D efforts.

[2] Services R&D data for 1992 were reported by the Swiss activities when this paper was essentially finished. They have been included in slected tables and graphics.

Impact of survey coverage

The main explanation for apparent underspending on services R&D in the latter seven countries is almost certainly the lower number of services industries included in national surveys and extent of coverage within these industries, especially of small and medium enterprises (SMEs). They all reported to the special OECD survey mentioned above, that they were not satisfied with their coverage of services R&D, (shown in italics on figure 3) as did also Finland, the Netherlands, Norway and Switzerland. (see box 2)

Japan currently has the lowest coverage as the only service industries included in the R&D survey are storage and broadcasting. As can be seen from table 3, Sweden does not include seven of the industries mentioned, Switzerland six, Finland and Belgium five and France three with some others only partially included. Sweden was the only one of them to be dissatisfied with the coverage of SMEs though there was some danger that coverage might decline in Japan.

Box 2. Impact of survey coverage on the level of services R&D

Response to coverage survey	High services R&D spenders	Medium R&D spenders	Low services R&D spenders
	Services over 15% of BERD	Services about 10% of BERD	Services under 10% of BERD
Satisfied	Australia (11) Canada (11) Denmark (11) New Zealand (11) Spain (11) United Kingdom (11) Portugal (9) Iceland (7) United States (11) Greece (4)	Ireland (11) Italy (11)	Mexico (9) Turkey (7)
Not satisfied	Norway (6)	Netherlands (9) Finland (5)	Austria (10)[3] bGermany (9) France (8) Belgium (6) Sweden (4) Switzerland (4) Japan (1)

( ) Number of service industries wholly or partly covered
Source: Tables 2 and 3.

[3] The Austrian reply on survey coverage relates to reference year 1993. The corresponding R&D data has not yet been published or supplied to OECD. The latest data available for this paper are for reference year 1989.

The R&D survey surveys in Germany and the Netherlands theoretically cover virtually all the service industries (excluding only wholesale and retail trade and other services) though R&D in the SSH is excluded. In the Netherlands the low figures for services R&D were attributed to the exclusion of firms with less than 50 employees and a lack of understanding of the concept of R&D in service firms. Additional guidance will be given as from the 1994 survey. In Germany the general-purpose panel used for the services industry was not felt to be appropriate for R&D surveys. The inclusion of the SSH is under discussion.

Norway was also dissatisfied despite having the highest percentage of BERD carried out in the services as the R&D survey did not cover four service industries.

At the other end of the scale there is a block of countries which are satisfied that there R&D surveys cover all or the vast majority of servce industry (shown in bold are figure 3) and where services R&D is over 15% of BERD. This includes Australia, Canada, Denmark, New Zealand, Spain, the United Kingdom and the United States plus Ireland and Itlay. These countries generally felt that SMEs were well covered with the exception of Spain which reported a possible 10 per cent underestimation due to SMEs and noted that an innovation survey in the services might turn up more R&D.

Greece, Iceland and Portugal, all with over 15 per cent of BERD in the services, were generally satisfied with their coverage of its services R&D though a number of industries were not fully covered. Mexico and Turkey, which have only recently launched their industrial R&D surveys felt that the services had been covered adequately.

It is difficult to judge the impact of the treatment of the social sciences and humanities on the amount of R&D reported for the service industries. Nine countries do not include it of which five were nevertheless satisfied with their services R&D data (Canada, Greece, Turkey, the United Kingdom and the United States) and four were disatisfied (Germany, Japan , the Netherlands and Norway) though Norway felt that R&D in the SSH was probably negligible. The SSH have only been added recently in Sweden. In others they are included implicitly without any special guidance as in Denmark. In others again such as Spain industrial firms are requested to provide a breakdown of their R&D by main field of science including the social sciences.

III. Breakdown by industry

For explanatory purposes it is useful to divide services R&D into groups according to their expected S&T intensity and to the main users of their results:

- commercial R&D firms and institutes (long standing, S&T intensive, technology for sale);
- computer services (new, S&T intensive, technology for own products and processes and for sale);
- communications (changing, S&T intensive, technology for own products and processes);
- transport and storage (changing to higher S&T intensity, technology for own products and processes);
- other design and engineering services (long standing, S&T intensive, technology for sale.);

– other services (not expected to be S&T intensive, technology for own products and processes).

Unfortunately it is not possible to distinguish between the last two categories in the data currently collected by OECD.

Supporting R&D data

Table 4 displays the data currently available from the OECD data-base for the main categories of services. It shows that a low percentage of BERD devoted to services R&D is associated with a very low degree of detail about the services concerned, usually explained by the low degree of coverage in the countries concerned.

Table 5 gives further details on services R&D expressed as a percentage of BERD for sixteen countries where this figure exceeds fifteen per cent and/or who have reported data to OECD in the revised classification. In general the discussion will concentrate on these countries. A simplified version is given in figure 4.

Box 3. Number of countries including selected service industries in their R&D surveys

NACE/ISIC		Yes	Partly	No
722	Software consultancy	22	0	2
73	R&D	22	0	2
642	Telecommunications	21	1	2
72 nec	Other computer services	21	0	3
60-63	Transport & storage	18	2	4
641	Post	18	0	6
70+71+74	Other business services	17	5	2
65-67	Financial services	15	3	6
50-52	Wholesale and retail trade	13	1	10
75...99	Community, personal and social services	12	2	10
55	Hotels and restaurants	8	1	15

Source: Table 3

Business Services

Judging from the results of the coverage survey summarised in box 3, the vast majority of countries include R&D services and computer services in their national R&D surveys. The treatment of other business services varies.

Box 4. R&D and other engineering units serving enterprises

a. Non-profit institutes serving enterprises

The core of the Business Enterprise sector is made up of private and public enterprises.

This sector also includes non-profit institutions (NPIs) who are market producers of goods and services other than higher education. These are of two kinds.

The first are NPIs whose main activity is the production of goods and services for sale at prices designed to recover most or all their costs. Such research institutes, clinics, hospitals, medical practitioners in private, fee-paying practices, etc., may be able to raise additional funds in the form of donations or own assets generating property income which allow them to charge below average cost.

The second are NPIs serving business. These are typically created and managed by associations of businesses whose services they are designed to promote, such as chambers of commerce, and agricultural, manufacturing or trade associations. Their activities are usually financed by contributions or subscriptions from the businesses concerned which provide "institutional" support for their R&D. However, any NPIs carrying out similar functions but controlled or mainly financed by government -- for example if they depend for their existence on a block grant from government -- should be included in the government sector.

A certain number of NPIs serving business have R&D, or a mixture of R&D and technical services, as their main economic activity.

b. Commercial R&D services

Traditionally most S&T intensive manufacturing firms had their own R&D centres to which they allocated block support. Since R&D was classified as an auxiliary activity in the System of National Accounts, these R&D centres were not separate establishments from a production point of view. At this period there was relatively little use by firms of purely commercial R&D services has firms in non-R&D intensive industries tended to use subsidised NPIs of the kind discussed under a) above.

In recent years two phenomena have changed this situation, the first the breaking up of large firms into more loosely linked units with, in some cases, the R&D centres being established as separate companies, the second the change in the System of National Accounts (CEC et al: 1994) making R&D an economic activity in its own right and proposing that a separate establishment be declared for R&D centres.

c. How they are classified by industry

ISIC Rev. 2 did not provide a separate category for R&D. ISIC Rev.3 does so as Division 73. Other engineering services with which they were grouped in the former OECD classification are included in 74.2 Architectural and engineering activities and related technical consultancy or 74.3 Technical testing and analysis.

In regular industrial statistics the R&D units identified above would now be included in division 73. In R&D statistics the treatment is slightly different. The aim has always been to associate R&D units with the industry they principally serve (especially if that industry virtually controls them) rather than tracking down the relationship via input-out tables. In the early days, the problem arose for co-operative research institutes. For example in 1966/67 about 70 per cent all ferrous metals R&D in the United Kingdom was undertaken in the British Iron and Steel Research Association.(CSO; 1973) In more recent years it has also arisen concerning commercial R&D firms. Hence in the Frascati Manual it is recommended that firms or institutes whose principal activity is R&D for a specified industry should be classified with that industry. According to the Frascati manual, only the units serving several industries should be included in Division 73.

The R&D services industry

In Norway and Iceland the services share of BERD is pushed above the average by the *"R&D industry"* partly because of their interpretation of the coverage and classification of R&D institutes serving enterprises (see box 4). Such institutes should be attributed to the business enterprise or government sectors according to whether they are controlled and mainly financed by enterprises or by government. The borderline is not easy to identify and Norway includes a number of such "semi-public" institutes in the sector. Furthermore, according to the Frascati Manual, the R&D services industry should only cover commercial R&D firms or research institutes which are generalists rather than serving a specific industry. In the latter case, for example a co-operative research institute, they should, contrary to ISIC general practice, be attributed to the industry they serve. Iceland and Norway, however, assign all R&D firms/institutes to the R&D service category rather than to distribute them to the industries served. InGermany, by comparison, under 10 per cent of the R&D by institutes is counted in the services and in France all R&D service units have been redistributed to the industries served. A second series for Norway has been supplied for the ANBERD data-base (see technical annex) with these institutes distributed. The resulting data have been plotted on figures 2 and 3 as Norway (adj) which is more or less on the diagonal.

The R&D service industry also represent 5-10 per cent of BERD in the United Kingdom (where it also includes some engineering services), Canada (possibly wider coverage), New Zealand and Italy.

Computer Services

In Greece nearly one quarter of BERD is performed in the *computer services industry.* In the other countries for which data is available the share is about 5-10 per cent. In France and Italy however, only 2½ per cent of BERD is carried out in the computer services industries.

The industry has two components, software services and other computer services. The former is usually the main R&D performer except in Norway where four percent of BERD is performed by other computer service firms

The amount of R&D reported for the computer services industry can be seriously affected by the way R&D on software is reported (see box 5). In theory, software R&D by firms principally engaged in computer services should be included in the latter whereas software R&D by firms in other industries should be included in the industry concerned. For countries which report by product field, R&D on software a which is produced for sale should be included in computer services whereas the development of new software undertaken for own use should be credited to the product concerned. Twelve countries replied to an OECD mini-survey on this topic in 1994 of which four major services R&D spenders (Australia, New Zealand, Norway and the United Kingdom), two medium ones (Ireland, Netherlands) and eight low spenders (Belgium, France, Germany, Japan, Switzerland and Turkey). Three of the latter, Japan, the Netherlands and Turkey reported that their survey did not include any firms for which software was their primary product. The other low services R&D spenders who replied did include such firms in the services.

Other business services

The majority of countries probably include some *other business services* in their R&D survey (box 3). Only Japan and Sweden reported that they were wholly excluded (Table 3). There are, however, variation in what is included in this group. In Denmark fifteen per cent of BERD is carried out in other

Box 5. Software in international statistical standard

Software has became a key means of production in industries and many resources are devoted to writing new software, adapting it to meet different uses, updating and publishing it. All these activities are relatively new, economically significant and result from the diffusion of IT over industries. Standard international statistical methodologies have recently been updated to incorporate these phenomena.

a) Software in standard industrial classifications

Software is both a product of the computer services industry and a process for those companies which acquire and use it (by analogy, for example with a machine tool).

The software consultancy and supply industry is separately identified as subgroup 722 of division 72 "computer and related activities" of ISIC Rev. 3 (NACE Rev. 1). The other components are hardware consultancy, data processing, database activities and other computer-related activities (UN: 1990).

The United Nations has issued a model survey framework for computer services (UN: 1990) which includes updated definitions for software products compared with the initial version of the CPC (UN:1988). The model survey distinguishes between packaged software and custom software and also between applications software and systems and user software.

b) Software as intangible investment

According to the latest edition of the System of National Accounts (EC etc.; 1995) Computer software (Computer programs, program descriptions and supporting materials both systems and applications software) that an enterprise expects to use in production for more than one year is treated as an intangible fixed asset. Such software may be purchased on the market or produced for own use. Acquisitions of such software are therefore treated as gross fixed capital formation. SNA gross fixed capital formation in software also includes the purchase or development of large data bases that the enterprise expects to use in production over a period of time of more than one year.

c) Software and innovation

Technological innovations comprise new products and processes and significant technological changes of existing products and processes. An innovation has been implemented if it has been introduced on the market (product innovations) or used within a production process (process innovation). Innovations therefore involve a series of scientific, technological, organisational, financial and commercial activities. (OECD; 1992).

On the product side one must distinguish between major innovations, incremental innovations and product differentiation and, on the process side, between the acquisition and introduction of software which is new (to the firm, industry or country) and that which is not significantly different from that already in use.

It follows that not all intangible investment in software will be innovation, for example the purchase of more copies of programs in use or of minor upgrades.

The current version of the Oslo Manual (OECD; 1992), which deals with technological innovation in manufacturing industry does not give any specific guidelines on the treatment of software. The next edition, which will cover the service industries, will do so.

d) Software and R&D

Research and experimental development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications. The basic criterion for distinguishing R&D from related activities is the presence in R&D of an appreciable element of novelty and the resolution of scientific and/or technological uncertainty, i.e. when the solution to a problem is not readily apparent to someone familiar with the basic stock of commonly used knowledge and techniques in the area concerned (OECD; 1994).

Guidelines on the treatment of software were included in the Frascati Manual for the first time in the 1993 edition . For a software development project to be classified as R&D, its completion must be dependent on the development of a scientific and/or technological advance, and the aim of the project must be resolution of a scientific and/or technological uncertainty on a systematic basis. Software-related activities of a routine nature are not considered to be R&D. The latter include work on system-specific or programme-specific advancements which were publicly available prior to the commencement of the work. Technical problems which have been overcome in previous projects on the same operating systems and computer architecture are likewise excluded as are software-related activities such as supporting existing systems; converting and/or translating computer languages; adding user functionality to application programmes; de-bugging of systems; adaptation of existing software; preparation of user documentation, which do not involve scientific and/or technologic advances, are not classified as R&D collection, and market research is also excluded.

R&D is, thus, only one of the stages in bringing a new software product to the market. Such innovation will also involve some of the routine activities listed above plus the reproduction;, distribution and all pre-launch marketing of the product.

The above criteria identify whether or not a given software activity is R&D in its own right. R&D expenditures also include software activities undertaken as part of an overall R&D project.

business services partly because this class includes special categories of institutions (Technical institutes 8.7 per cent of BERD) and also because they included R&D spending by design and engineering services which in some countries such as the United Kingdom are still included in the R&D industry. The share is also over five per cent in Australia and Spain.

The communications and transport industries

The *communications industries* are surveyed in virtually all countries. They are particularly important R&D performers in Portugal (12 per cent). The average appears to be about 2-5 per cent of BERD. Only about half a dozen countries have, as yet, reported the distinction between post and telecommunications (often with a nil return for post) and some still group communications with transport and storage. In some countries, notably Switzerland the post office is still included in the government sector.

When the *transport and storage* is surveyed (perhaps two thirds of countries) and is separately available, the industry carries out at best one percent of BERD.

Other service industries

The degree to which countries include these industries in their R&D surveys seems to differ a great deal.

Some two thirds of those responding to the coverage exercise did survey *Financial intermediation services* (box 3). The industry carried out seven percent of BERD in Canada and four percent in Australia. Elsewhere the share was one percent or less

Only half the countries included *wholesale and retail trades* in their R&D survey. The results varied considerably. In Australia, Denmark, Canada and New Zealand some five percent or more of all industrial R&D was carried out in the industry dropping to one percent or less in the others. The comparatively high share for New Zealand is explained by the inclusion in the industry of the "producer boards (3 per cent of BERD).

Very few countries appear to include *hotels and restaurants* in their surveys and any R&D reported was a negligible share of BERD.

Community, personal and social services are at the borderline between the business enterprise and government sectors for R&D statistics. Perhaps half the countries include some of these industries in their industrial R&D survey, representing under one percent of BERD, except in Mexico.

In conclusion, there is evidence of some R&D in all these other service industries. In Australia, Canada and Denmark they represent a noticeable share of total industrial R&D. In most of the others they are not yet significant at this level.

Example of consequences for monitoring and analysis

How far do the differences mentioned above affect our interpretation of more general data on industrial R&D? Total BERD as a percentage of GDP is a popular indicator of the strength of a nation's R&D effort. Figure 5 shows the contribution of the services, as currently reported to this figure. The ranking order is still largely fixed by the level of manufacturing R&D. For example three of the four

highest spenders, Sweden, Japan and Germany report very little services R&D. However without the services (and other non-manufacturing) the United States would drop one rank and Denmark, Norway and Canada several places.

This comparison does not take into consideration the differences in industrial structure between the countries. Thanks to the ANBERD database (see technical annex) it is possible to calculate and compare R&D intensities for individual manufacturing industries and to establish weighted averages which adjust for such differences. As yet the quality of the data available both for the numerator (R&D) and the denominator (production or value added) does not permit such comparisons for the services.

IV. Role of IT-related R&D

The study of the diffusion of technology cited above (Papaconstantinou *et al* 1996) confirmed the generally held view that IT was penetrating deeply into the services incorporated in materials and more especially in equipment. It is more difficult to asses how far the R&D in the service industries is linked to this phenomenon. Suitable data is not available from OECD sources but some information of varying specifications can be found in national publications. For example both Japan and Italy include special questions on IT in their national R&D surveys and publish tables showing the percentages of firms and of R&D expenditures concerned. Some countries collect data on the product towards which R&D is oriented as well as the industry in which it is performed. Denmark, a country with good services coverage, does so and identifies product fields both for computers and office machines and for computer services. Canada has included special questions on software R&D in its industrial R&D surveys. The data is shown in tables 6a to 6f.

In both Japan and Italy about 40 per cent of services firms undertake some IT R&D, a significantly higher percentage than the average for manufacturing. In Japan the share of total intramural R&D spent on IT is the same in the services as in manufacturing and has not risen significantly, always remembering the low coverage of the services in the Japanese survey. In Italy IT absorbs about three quarters of the R&D spending of business services firms which reported IT R&D as against one quarter in such firms in the communications industry and in R&D centres. These shares are broadly comparable with those reported by the IT hardware industry and in other electrical and instruments manufacturing.

The results for Denmark show, as might be expected that the service industries do very little R&D on computer hardware although there is spending on communications equipment R&D. Overall one quarter of services R&D is related to computer services. The situation varies considerably between industries. Again, as might be expected, R&D the computer services industry is almost exclusively concentrated in this area. About three quarters of all R&D reported by “other service industries” is computer related. Although the actual sums are small it does suggest that induced R&D in low-tech service industries is mainly IT-related.

This is confirmed by the Canadian data which show that over half of all R&D in the services is software-related, twice the proportion in manufacturing. As in Denmark, this is the main type of R&D in the computer services industry but software R&D is also predominant in the finance and insurance industries.

V. Government financed R&D in the services

Data is available for only half of all Member countries including seven high services R&D spenders (Australia, Canada, Denmark, Finland Norway, Spain and the United States), six low spenders (Austria, Germany, Mexico, Japan, Sweden and Turkey) and one medium one, (Italy).

In the majority of these countries government finances a higher proportion of R&D in the services than in manufacturing (see figure 6). The difference is particularly marked in Austria, Italy, Germany, Norway and Spain where the government funds over 20 per cent of all services R&D. The share in manufacturing is higher in the United States, France and Sweden where there are flows of defence funds and also in Ireland where funds from abroad are particularly important. (Table 7)

Judging from the data from only ten countries, (Table 8) the government funds for services R&D appear to go largely to business services and more especially to R&D services (and/or institutes) especially in the countries where the government contribution is high. The funding pattern for computer services R&D varies considerably between the seven countries for which data are available, ranging from a high of 24 per cent of intramural R&D in the United States to only 2 per cent in Australia and even less in Mexico. Similar variations occur for communications R&D. Except in Australia a very low share of government funds for services R&D go to the remaining "non-S&T intensive" industries.

VI. Trends over time

The share of BERD credited to the service industries grew in virtually all Member countries between 1981 and 1993. (Table 9) This is only to be expected given their increased role in total industrial activities. However, as can be seen from figure 7, reported R&D expenditure in the services grew much more rapidly than value added almost throughout the OECD area.

Changes in the level and structure of services R&D

There are a number of explanations for this almost universal increase in the apparent R&D intensity of the service industries (Table 9) though they are not easy to confirm from the data currently available.

Growing propensity to perform R&D

The existing low-tech service industries may be actually carrying out more R&D on their own products and process. This may be formally organised R&D as described in the early Frascati Manuals or more informal R&D as identified by Kleinknecht (Kleinknecht 1987, Kleinknecht and Reijnen 1991) and as discussed at length during the preparation of the most recent version of the Frascati Manual (OECD; 1994) (see box 5). Given the lack of suitable time series for these industries, it is difficult to test this hypothesis.

Changing pattern of relations between manufacturing and service industries

Another possible reason is that manufacturing firms are doing less intramural R&D (including software R&D) and are putting it out to professional R&D (and software development) firms which already existed or which they have created by hiving off their own R&D establishments. The 1995 coverage survey

also included a question on the growth of outsourcing. Several countries reported having some evidence of the phenomenon, for example an increase in extramural R&D spending by manufacturing industry.

Treatment of software R&D

A further cause of the growth in R&D in the series is the rise in software R&D and the grouping of units for which software provision is their main activity in the computer services industry. Table 10 shows R&D in the computer industry and in the computer services industry for selected years as a percentage of BERD. By 1993 computer services is the larger of the two in many countries. This change of balance may be caused by the rise of new software houses but also by reorientation of the activities of existing computer companies away from cost-competitive hardware products towards the higher-value-added computer services. In R&D surveys where whole firms are classified to one industry or the other the effect can be striking as can be seen between 1991 and 1993 the United States in table 10.

National data for Ireland also illustrate the changing pattern of software R&D over time. In 1988, Irish industry spent I£7 million on software R&D which was credited in the breakdown by industry to the electronics industry. By 1993 total software R&D had risen to I£56 million pounds partly because of the emergence of new software houses but mainly because very large foreign-owned firms which already undertook R&D in Ireland shifted the emphasis of this work from hardware to software. I£35 million of the software R&D (62.5 per cent) was reported as being undertaken in the software services industry of which I£10 million for general purpose software houses, I£8 million for software companies working almost exclusively for the telecommunications industry and I£17 million for subsidiaries of companies in the office and computer machinery sector.

In Canada in 1988, as in Ireland, most software R&D was performed in manufacturing, notably in the "telecommunication and electronic equipment" industry (44 per cent) followed by "business machines" (16 per cent) and only then by computer services (15 per cent). Unlike in Ireland the shares of computer services and business machines changed little between 1988 and 1993. The big increase came in finance and insurance with a decline in telecomms equipment (Table 11). However Danish data for 1993 are similar to those for Ireland in the later year with 61 per cent of total spending on data-processing-related R&D carried out in the computer services industry, seven per cent in the office machinery industry, and five per cent each in other services, technical service institutes and transport and communication. The remaining 16 per cent was spread over a wide range of industries.

In Canada the 80 per cent overall increase in R&D spending in the service industries between 1988 and 1993 (at GDP in input prices) was almost entirely due to software R&D. Non software R&D in these industries grew actually only about 15 per cent over the same period.

Transfer of units from the government sector

Following changes in the status of some public service agencies, R&D institutes are being transferred to the business sector, as happened in France in their 1992 survey.

Impact of survey coverage

However, the main difference over time in the services R&D data currently available probably remains the coverage of R&D surveys. Unfortunately, countries' responses to the section of the survey on coverage dealing with changes were generally less detailed than on the current situation, though a number

reported improvements notably for computer services/software. Other information can be gleaned from footnotes to the database, national publications and observation of the data themselves.

For example, it is noticeable that in all the low services R&D spenders there was little or no growth over the 1980s in the share of BERD carried out in the services and the percentage actually fell in Austria, Belgium, (where there are other coverage problems) and Japan, suggesting that their surveys may not have been extended to cover the new phenomena. This is confirmed from the coverage survey .

A number of countries, notably Denmark, Australia and perhaps also Canada and Portugal were, data already amongst the highest services R&D spenders in 1981 according to the second OECD S&T Indicators report (OECD; 1986). Others, such as Norway, revised their data retrospectively during the 1980's. However, the main changes are relatively recent and reflect, perhaps, a changed attitude towards industrial R&D surveys.

These surveys were originally set up in order to obtain an estimated total for Business Enterprise R&D plus details for industries of particular interest. Industries and firms known to have significant R&D (almost exclusively in manufacturing) were included in full whereas industries with little R&D were only sampled. Given the pressure to reduce the survey burden on industries, the sample base was kept small in many countries except for rebasing years (every four years for example in the Netherlands or the United Kingdom and even longer in the United States). Historically the core R&D firms in aerospace, electronics, chemicals etc. were responsible for up to 80 per cent of total BERD in major OECD countries. Occasionally the picture was disturbed by data coming from other sources, notably information about firms receiving R&D aid (grants or tax relief) from the government as in France and Germany or from special studies as in the Netherlands (e.g. Kleinknecht op.cit.). This added a large number of firms (mostly SME's) but did not usually increase total BERD substantially and hence did not lead to immediate extension of official R&D surveys.

Box 6. Recommendations on Measuring R&D in SMEs

R&D has two elements: R&D carried out in formal R&D departments and R&D of an informal nature carried out in units for which it is not the main activity. In theory, surveys should identify and measure all financial and personnel resources devoted to all R&D activities. It is recognised that in practice it may not be possible to survey all R&D activities and that it may be necessary to make a distinction between "significant" R&D activities which are surveyed regularly and "marginal" ones which are too small and/or dispersed to be included in R&D surveys.

It is recommended that significant R&D should include all units where at least one full-time equivalent (FTE) is worked on R&D per year.

This is mainly a problem in the business enterprise sector where it may be difficult and costly to break out all the *ad hoc* R&D of small companies. It may also be a problem in other sectors, e.g. local government or teaching establishments at ISCED level 5

Efforts should be made via other sources (e.g. innovation surveys) to establish estimates for units with even smaller R&D efforts. However, such small amounts of R&D should only be included if the R&D is undertaken on a basis consistent with the basic definition of R&D .

Extract from Chapter 7 of the Frascati Manual (OECD; 1994)

During the 1980s spending on industrial R&D as reported by regular surveys seemed to meet policy priorities as it grew steadily and the percentage financed by government fell, hence there was little pressure to change the surveys. At the beginning of the 1990s the situation changed. The work of the Voorburg Group and the revision of the Frascati Manual highlighted software R&D and computer services. The first round of innovation surveys based on the new "Oslo Manual" (OECD; 1992) brought to light even more SMEs with some sort of R&D activities which were not included in the regular survey (See for example, Lhuillery and Templé; 1994) and the revised Frascati Manual (OECD; 1994) (see box 6) also deals with this issue. The new OECD R&D questionnaire also encouraged interest in reviewing survey cover. This pressure was strengthened by the downturn in R&D spending reported by the "old core" manufacturing firms in the 1991 surveys.

A number of Member countries, for example the United States and the United Kingdom rebased their surveys in 1992/93 and have reported retrospective revisions which attenuate the major declines originally reported for 1991/92. In the United States the coverage of the services was clearly extended with the share of non-manufacturing in BERD reported for 1991 rising from 8 per cent to 24 per cent. In the United Kingdom, where firms report by main product field, the list of products was extended to include computer services and commercial R&D leading some companies to reclassify R&D which they had previously included in manufacturing, leading to a rise for the services percentage from 11 per cent to 16 per cent.

Example of consequences for analysis and monitoring.

From the late 1970s to the middle to late 1980s there was a was a period of sustained growth in industrial R&D expenditure in virtually all OECD countries followed by slow down and even decline in some countries in the 1990s. The earlier growth seems to have been relatively unaffected by the business cycle so other explanations must be sought. It is clear that the proportion of BERD contributed by the service industries grew in the majority of countries over the eighties (table 9). Was this sufficient to fuel the overall growth and how did it affect the subsequent levelling off?

Figure 8 shows the contribution of the service industries to the gross increase in BERD (at 1990 GDP prices) over three four year periods, 1981-85, 1985-89 and 1989-93. The services contribution is a combination of its weight in BERD at the beginning of the period and the speed of growth in these industries. The latter, in turn, will be a combination of real growth in R&D spending and increases due to improved coverage.

The services were not the cause of the overall growth in BERD in the 1980s, and its concentration in the first half of the decade. With or without them the rates are higher for 81 to 85 than for 85 to 89. Nevertheless services R&D did make a significant contribution to growth in BERD in the first period in Norway, Canada, Denmark Finland and Iceland and in the second period in Australia. In Finland and Spain R&D grew rapidly in both components between 1985 and 1989 whereas in the United Kingdom, Canada and the United States the services already contributed most or all the growth which occurred.

The latter pattern spread to a much larger number of countries in the most recent period. Ireland and Australia reported the highest growth in industrial R&D between 1989 and 1993 with only a modest contribution from the services. However in the remaining countries much of the little growth reported did occur in the services, with a decline in the other industries in Norway, the United States the United Kingdom, the Netherlands and Italy and no change in France. Only in Finland did services R&D decline whilst that in other industries grew. What one cannot do is to identify how far this growth in the services

is real, is due to reclassification of units from manufacturing or is purely a matter of extended survey coverage. The percentage of services in BERD actually declined between 1991 and 1993 in a number of countries (table 9).

VII. Conclusions and need for future work

It is evident that the services industries can no longer be treated simply as importers of technology from manufacturing and also that the relationship between manufacturing and the technology-supply services industries (R&D computer service, etc.) has become more complex than in the past. Many Member countries have made considerable efforts to improve their R&D surveys in order to be able to monitor these changes and others are intending to do so. For example the Japanese authorities are testing a survey form for the software industry and are contemplating other changes such as the inclusion of R&D in the social sciences and humanities.

All these survey extension and reclassification exercises improve the quality and comparability of the data but at the price of introducing breaks in series which hinder the analysis of trends over time especially when they are not documented and/or where series are splined back to give an impression of actual growth.

This has only been a report on work in progress as it may be several years before a full set of comparable data for services R&D is available and the quality of existing data for a number of Member countries is still not satisfactorily documented at OECD.

Only when such data has been incorporated in the ANBERD database and corresponding internationally comparable industrial data are included in the STAN database will it be possible to evaluate services R&D in its structural context (see technical annex).

Furthermore this paper has only looked at total intramural R&D expenditure in the services together with a very quick glance at its sources of funds. Additional analyses can be undertaken using OECD data-bases of the numbers and type of R&D personnel in the services and also of R&D expenditures broken down by type of cost.

However, the next major step in quantifying and understanding the production and use of technology in the services industries will be their inclusion in surveys of innovation activities. Several pilot studies have already been made but a concerted effort will not be attempted until after the revision of the Oslo Manual (OECD; 1992), scheduled to be issued in 1996.

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TECHNICAL ANNEX

R&D data-bases

Until recently the data for the OECD survey for R&D in the business enterprise sector broken down by industry (ISIC Rev. 2) were stocked in a data-base named **BERD** and were published, as reported by the countries in *Basic Science and Technology Statistics* (OECD; annual a). The services breakdown is shown in table A1. However, mainly due to problems of confidentiality the detail available declined over time and it became increasingly difficult to use the data for analysis. In consequence a new data base was constructed called **ANBERD** with the objective of creating a consistent data set for manufacturing industries which overcomes the problems of international comparability and time discontinuity associated with the data supplied by Member countries. It makes considerable use of estimation to adjust data and to fill in gaps to give a full set of total intramural R&D expenditure data broken down by manufacturing industry (ISIC Rev. 2) for 17 OECD countries. The associated OECD publication (OECD, annual b) also includes the corresponding data as reported by Member countries.

Following a decision to introduce all the changes in the fifth edition of the Frascati Manual (OECD:1994) in the OECD R&D questionnaire for reference year 1991, (covering the years 1989-92) the new classification was applied in the tables on R&D in the business enterprise sector. A new data-base, entitled **DIRDE** was established to stock the returns framed in terms of ISIC Rev. 3/NACE Rev.1. In consequence there are now two segments of the EASD database dealing with industrial R&D as reported by countries, BERD based on ISIC Rev. 2 (ending about 1990) which is no longer updated and DIRDE based on ISIC Rev. 3 which is now updated. The services breakdown is shown in table A2. The old data (from 1981 onwards) were carried forward from BERD to DIRDE using a very rough key and countries were invited to provide retrospective revisions. With one or two exceptions, most were unable to report in the new format earlier than 1987 and some not until 1991 or later. Data using this new classification were issued in 1995 in both the OECD publications mentioned above. The ANBERD data-base itself will only be changed to ISIC Rev 3 in 1996.

Metadata

The preparation of ANBERD has given the Secretariat detailed knowledge of the coverage and classification of national R&D data for manufacturing. For service industries OECD only currently stocks the data as reported by countries with relatively little information on sources and methods. The metadata for the services has not yet been compiled in convenient form other than in the ANBERD country notes which are in the process of being adjusted to ISIC Rev 3.

Two mini-surveys of methodology have been undertaken, one in 1994 dealing with the treatment of software R&D and the second in 1995 requesting information on the coverage of services in national R&D surveys. Only about half the OECD countries responded to the first of mini-surveys rising to twenty four of

them in the second one. Nevertheless, this paper is based on an incomplete set of methodological information, particularly of changes over time.

Comparison with value-added

Data sources

At various points the paper comparisons are made between services R&D and services value added. For all countries except Ireland, Switzerland and Turkey the value-added data were extracted from the STAN data-base. The Structural Analysis Industrial (STAN) database covers 49 manufacturing sectors in 21 OECD countries and Korea from 1975 to 1994, thereby providing the most complete international data on industrial activity available to date. STAN contains estimates comparable with national accounts for the following measures of industrial activity: production, value added (at current and constant prices), gross fixed capital formation, number engaged, labour compensation, exports and imports.

The STAN data-base is currently being extended to included the service industries. The services for non-manufacturing industries are currently being compiled in the classification shown as column 1 of Table A3. They are not yet fully annotated and estimates have not been made for missing data points. They are derived from two other OECD data-bases, ISDB and ANA.

ISDB		ANA
Australia	United States	Austria
Netherlands	Canada	Greece
Belgium	Japan	Iceland
Germany	Denmark	New Zealand
France	Sweden	Portugal
Finland	Italy	Spain
	United Kingdom	Mexico

ISDB like STAN is a second level data-base which combines information from national and international sources to provide coherent sets of data. It is prepared and published by the OECD Statistics Directorate. The classification used is ISIC Rev.2. The classification of non-manufacturing industries used is show in column 2 of table A3. It is slightly more detailed than that in STAN.

For STAN countries which are not in the ISDB the data has been compiled directly from the OECD ANA basis of national accounts statistics as reported by Member countries. The recommended breakdown of GDP by economic activity in theory is much more detailed than the other two. In practice very few countries provide anything like this detail for the services, hence the simpler lists in the second level bases.

For the non-STAN countries it was possible to find some relevant data in ANA for Ireland, Switzerland and Turkey. In the case of Ireland a services figure could be obtained but not for manufacturing. Hence Ireland does not appear on figure 3.

Comparison with R&D data

The two sets of data come from different sources, and then are certainly special problems for each country. Here we can only mention some general points.

First in the value added series only part of indirect taxes is taken into account for the breakdown by economic activity since not all the taxes could be allocated by industry. In ISDB all taxes are grouped together in a special category.

Second for Canada, Denmark and the United Kingdom value added is given at factor values and is expressed in basic values in Finland.

Third for R&D purposes the "category community personal and social services" is at the borderline between the business enterprise sector and other sectors. Given the very little R&D reported for it, the measure of total services value-added used to calculate the "apparent R&D intensities" and to compare rates of growth covers only ISIC 6, 7 and 8. However, in NACE "real estate and business services" are grouped with "community, social and personal services". The data for Belgium, Germany and Italy in the ISDB follow this approach leading the some degree of overestimation of their respective apparent R&D intensities for the service industries.

In the comparison of growth rates, the value added data were taken for the data-bases mentioned above already at fixed prices. The R&D series were deflated using the implicit GDP price index.

Table A1. The Services in the BERD data-base

Code	Title	ISIC Classification[1]
33	Utilities	Major division 4
34	Construction	Major division 5
35	Transport, Storage	71
36	Communications	72
37	Commercial and Engineering Services	8324 (if not distributed by ind.) 9320 (if relevant)
38	Other Activities	6,81,82,83 (except 8324) and any items of included in sector
39	TOTAL SERVICES	4+5+6+7+8+9 (if relevant)

1. International Standard Classification of All Economic Activities: Series M, No.4, Revision 2 (United Statistical Paper).
Source: Basic Statistics of Science and Technology (OECD, 1991).

Table A2. The services in the DIRDE data-base

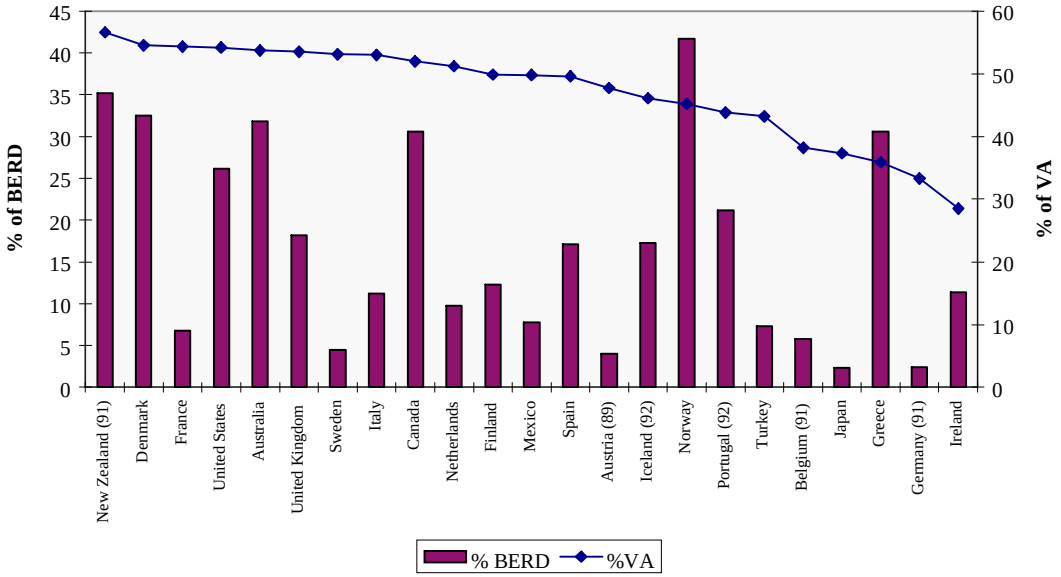
Code	Title	ISIC Rev.3.Division/Group/Class	Approximate correspond. ISIC Rev.2 Division/Group/Class	Corresponding NACE Rev.1 Division/Group/Class
45.	**SERVICE SECTOR**	**50 thro'99**	**6 thro'9**	**50 thro'99**
46.	**Wholesale, Retail Trade & Motor Vehicle etc. Repair**	**50 thro'52**	**61+62+6(part)**	**50 thro'52**
47.	**Hotels & Restaurants**	**55**	**63**	**55**
48.	**Transport & Storage**	**60 thro'63**	**71**	**60 thro'63**
49.	**Communications***	**64**	**72**	**64**
50.	Post	641		64.1
51.	Telecommunications	642		64.2
52.	**Financial Intermediation (including Insurance)**	**65 thro'67**	**81+82**	**65 thro'67**
53.	**Real Estate, Renting & Business Activities**	**70 thro'74**	**83+932**	**70 thro'74**
54.	Computer & Related Activities	72	8323	72
55.	Software Consultancy	722		72.2
56.	Other Computer Services nec	72 less 722		72 less 72.2
57.	Research & Development	73	932	73
58.	Other Business Activities nec	70+71+74	83(part)	70+71+74
59	**Community, Social & Personal Service Activ., etc.**[a]	**75 thro'99**	**9 less 932**	**75 thro'99**

a. Activities carried out in these industries by the Business Enterprise sector only. Figures are expected to be negligible: the heading is included as an aide-memoire
Source: Questionnaire for OECD R&D survey - 1993 edition

Table A3 The Services in the STAN and ISDB data-bases

	STAN	ISDB
Wholesale and retail trade, restaurant and hotels	x	xx
Wholesale and retail trade		x
Transport, storage and communication		x
Transport and storage	x	x
Finance, insurance, real estate and business services	x	x
Financial institutions	x	x
Insurance		x
Real estate and business services		x
Community, social and personal services	x	x
Total Services (by addition)	x	x

Figure 1. Services as a percentage of BERD and Industrial Value added 1993 [1]



Sources: Figures 1, 2, 3 7: OECD, DIRDE and STAN databases, February 1996;

Figures 4, 5, 6 8: OECD, DIRDE database, February 1996.

Figure 2
Services R&D 1993
(or nearest year available)

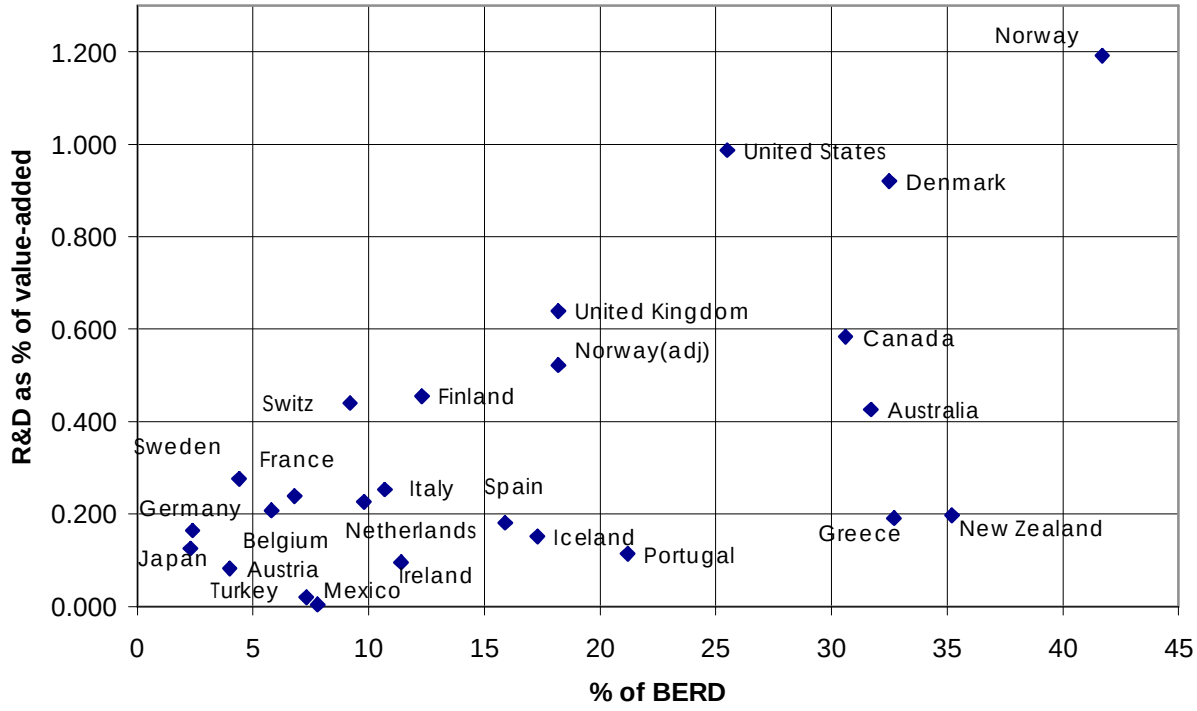


Figure 3
R&D compared with value added (GDP)

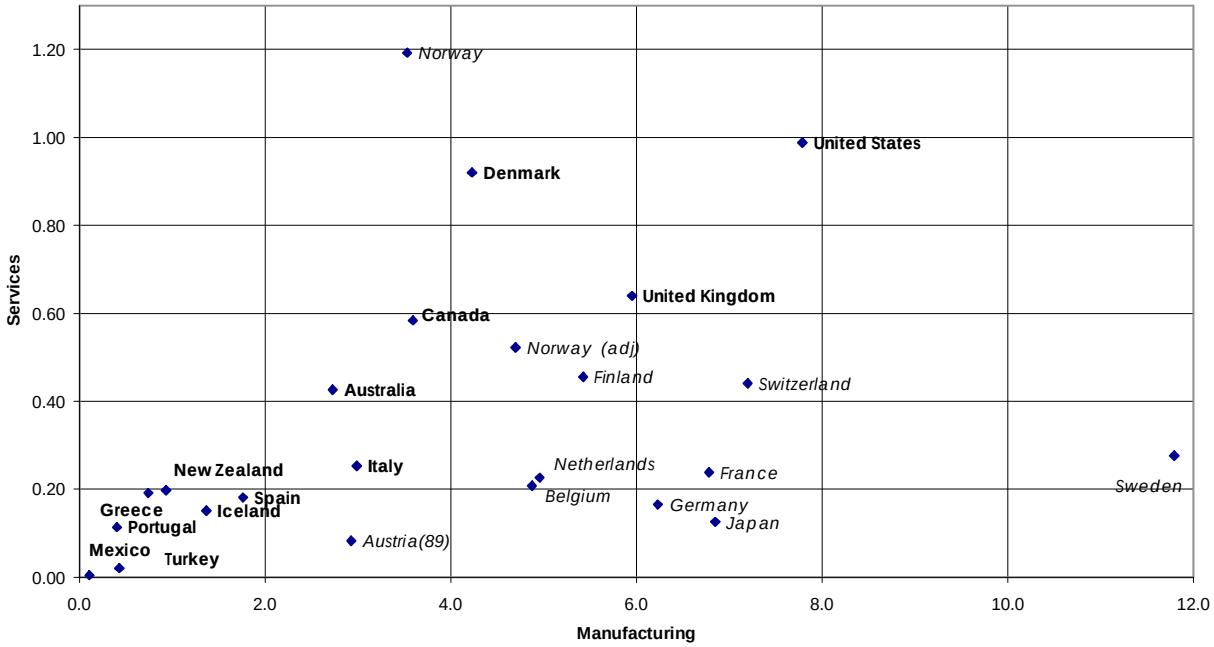


Figure 4. Services R&D as % of BERD by industry 1993

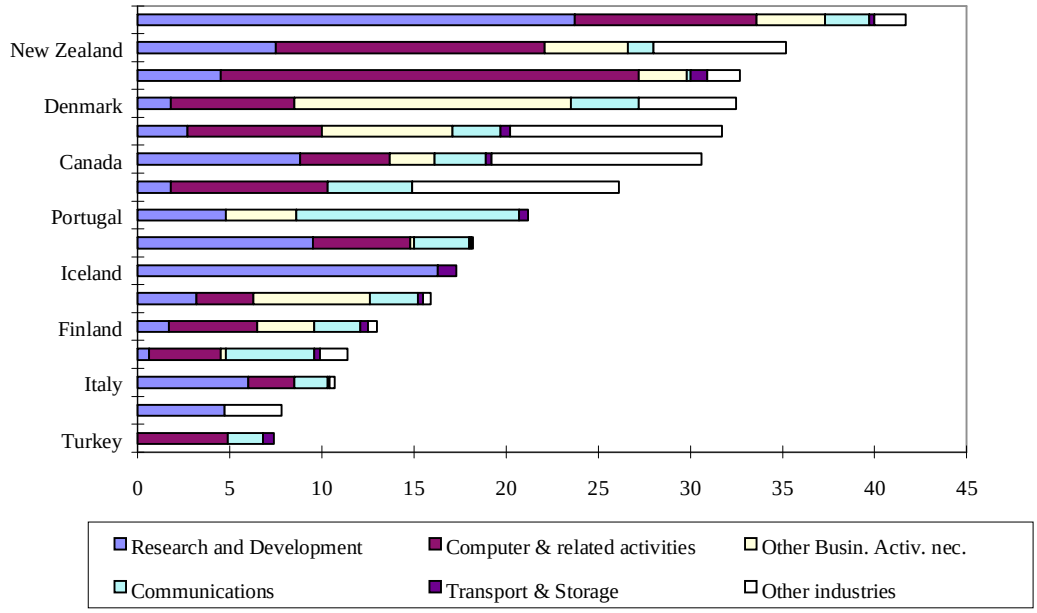


Figure 5. BERD as a percentage of GDP 1993

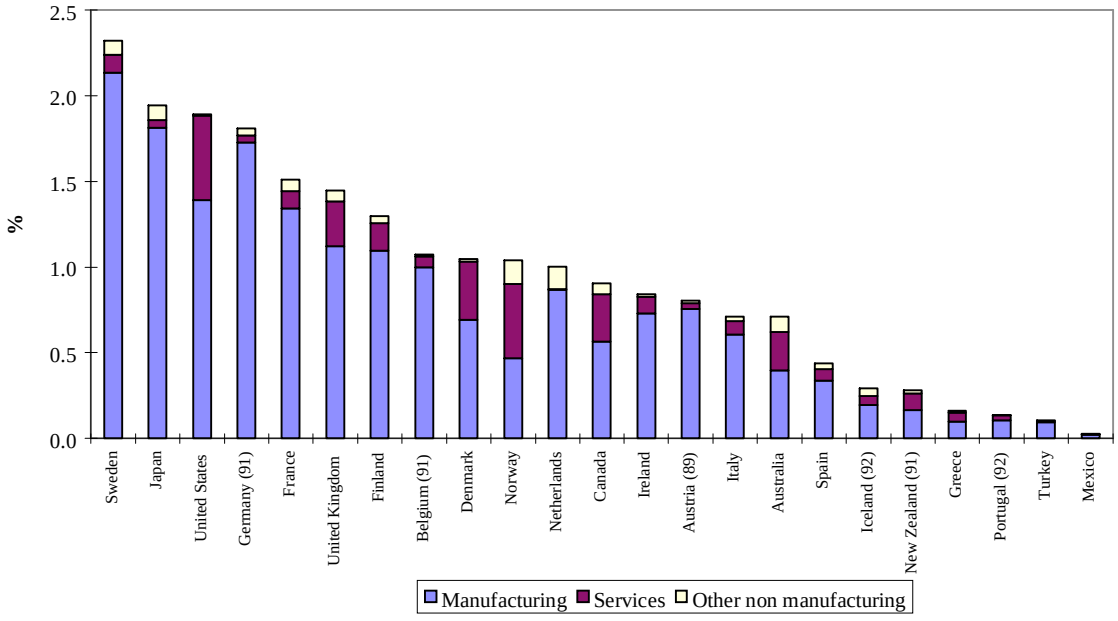


Figure 6. Percentage of R&D financed by government 1993

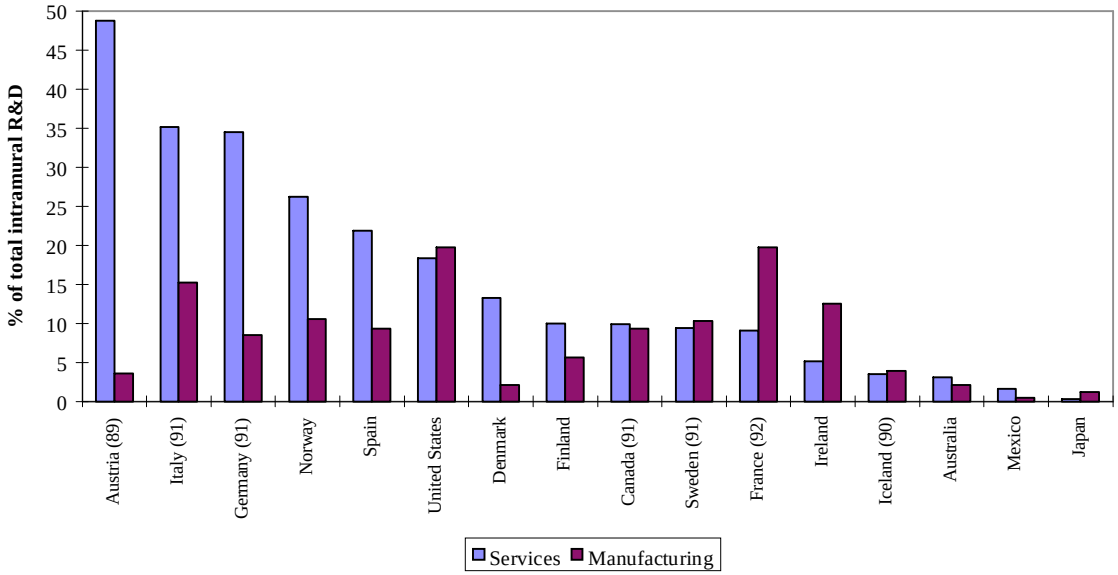


Figure 7. Apparent average annual growth in services R&D 1981 to 1993 compared with total services (VA)

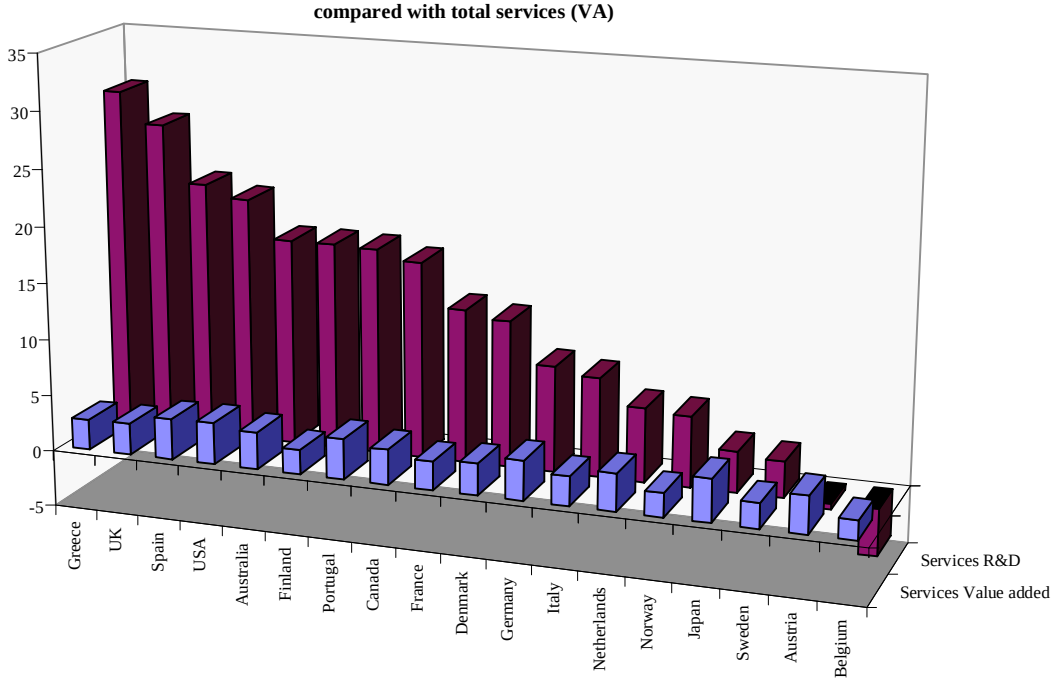
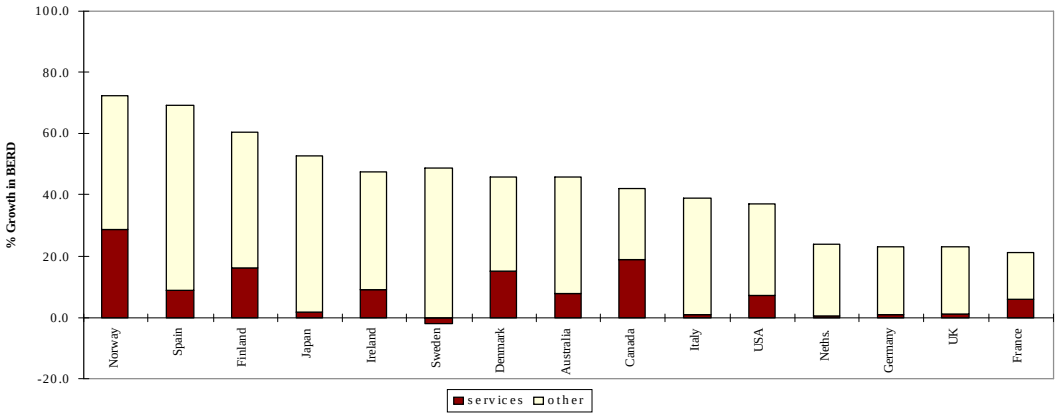
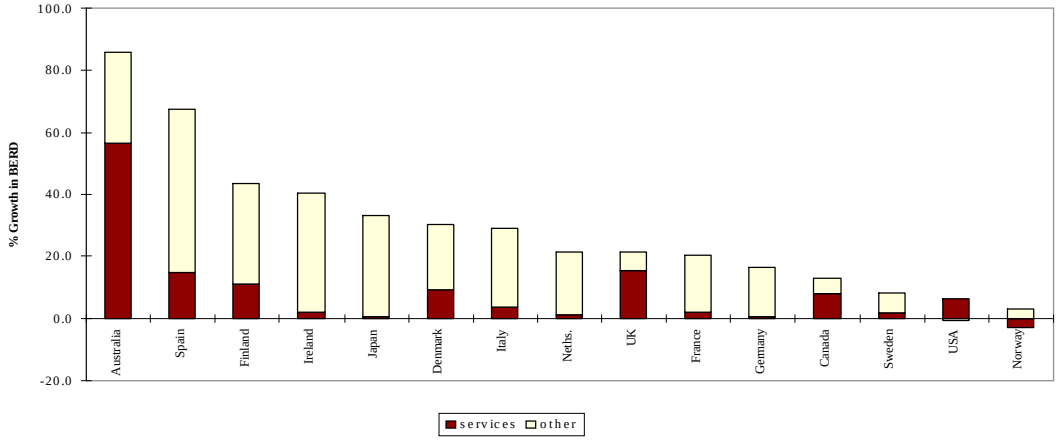


Figure 8. Contribution of the services to growth in BERD

1981-1985



1985-1989



1989-93

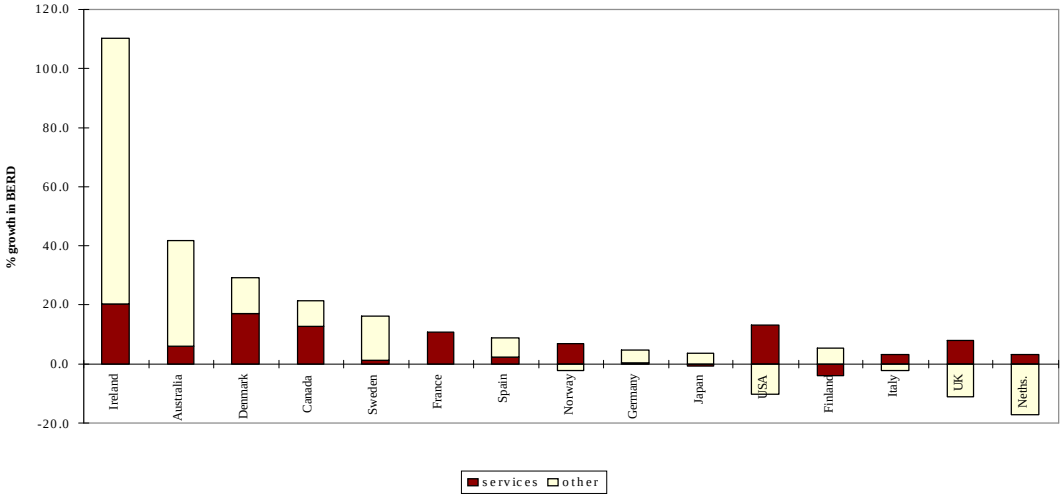


Table 1. Industrial value added by main industry groups as a percentage of total industry 1993

	Agriculture	Mining	Manufacturing	Utilities	Construction	Services
Australia	3.2	3.9	14.7	3.4	6.3	68.5
Austria (89)	3.8	0.4	31.4	3.5	8.3	52.6
Belgium (91)	2.2	..	..	..	6.6	62.3
Canada (91)	2.9	3.8	20.6	4.3	8.1	60.4
Denmark	4.5	1.3	24.0	2.6	6.7	61.0
Finland	6.5	0.5	30.2	3.3	5.9	53.7
France	2.9	0.6	24.5	3.1	6.1	62.8
Germany (91)	1.5	0.6	35.6	2.8	6.2	53.3
Greece	15.4	1.3	17.3	2.9	7.4	55.7
Iceland (91)	14.4	..	19.6	4.5	9.1	52.3
Ireland (92)	9.1	..	..	..	5.8	46.6
Italy (94)	3.4	..	24.2	6.8	6.0	59.6
Japan	2.3	0.3	28.6	3.1	11.0	54.8
Mexico	7.1	1.8	21.3	1.6	5.6	62.6
Netherlands	3.8	3.3	20.8	2.0	6.1	64.1
New Zealand (90)	8.7	1.7	20.7	3.4	5.0	60.4
Norway (91)	3.8	17.1	17.4	5.1	5.0	51.6
Portugal (89)	7.1	..	32.6	4.3	6.2	49.8
Spain (92)	4.0	..	..	..	10.0	..
Sweden	2.9	0.4	25.7	4.2	8.1	58.7
Switzerland (91)	3.4	..	26.3	2.1	9.0	59.3
Turkey	17.3	1.2	23.3	2.9	8.3	47.0
United Kingdom	2.1	2.5	24.5	2.9	6.0	61.9
United States	1.9	1.6	19.8	3.2	4.2	67.6

Source: OECD, National Accounts database, February 1996.

Table 2. R&D in the Business Enterprise sector (BERD) by main industry group 1993

	Agriculture	Mining	Manufacturing	Electricity	Construction	Services	Total
Australia	..	10.2	55.7	1.9	0.5	31.7	100
Austria (89)	0.2	0.4	94.1	0.6	0.7	4.0	100
Belgium (91)	0.5	0.2	93.1	0.1	0.4	5.8	100
Canada	0.7	2.6	62.3	3.6	0.2	30.6	100
Denmark	0.6	0.0	65.9	0.4	0.5	32.5	100
Finland	0.1	0.4	84.5	2.1	0.6	12.3	100
France	1.1	0.7	88.7	1.9	0.8	6.8	100
Germany (91)	0.2	0.6	95.4	0.5	0.3	2.4	100
Greece	1.1	3.7	61.3	1.2	..	32.7	100
Iceland (92)	5.6	0.4	66.9	4.1	5.8	17.3	100
Ireland	0.6	0.3	86.9	0.6	0.2	11.4	100
Italy	0.0	0.0	85.2	4.1	0.0	10.7	100
Japan	0.1	0.3	93.4	1.2	2.7	2.3	100
Mexico	..	1.6	86.7	4.0	0.0	7.8	100
Netherlands	2.9	0.0	86.7	0.1	0.5	9.8	100
New Zealand (91)	2.2	2.4	58.8	..	1.3	35.2	100
Norway	0.2	11.7	45.1	0.2	1.2	41.7	100
Portugal (92)	0.1	0.4	76.9	1.3	0.1	21.2	100
Spain	2.0	0.8	76.9	3.8	0.5	15.9	100
Sweden	1.1	0.3	92.1	1.3	..	4.4	100
Switzerland (92)	..	..	90.3	..	0.5	9.2	100
Turkey	0.5	0.4	88.8	3.0	0.0	7.3	100
United Kingdom	1.0	0.7	77.6	2.4	0.1	18.2	100
United States	..	..	73.6	0.3	..	26.1	100

Source: OECD, DIRDE database, February 1996; DSTI/EAS Division.

Table 3. Service industries included in latest survey in selected OECD countries

a) by country

NACE/ISIC		Australia	Austria	Belgium	Canada	Denmark	Finland	France	Germany	Greece	Iceland	Ireland	Italy
50-52	Wholesale and retail trade	Y	Y	N	Y	Y	N	N	Y	N	N	P	Y
55	Hotels and restaurants	Y	N	N	Y	N	N	N	N	N	N	PP	Y
60-63	Transport & storage	Y	Y	Y	Y	Y	N	Y	Y	N	Y	P	Y
641	Post	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	Y
642	Telecommunications	Y	Y	Y	Y	Y	P	Y	Y	Y	Y	Y	Y
65-67	Financial services	Y	Y	Y	Y	Y	N	N	Y	P	N	P	Y
70-74	Business services	Y	Y	P	Y	Y	Y	P	P	P	Y	P	Y
722	Software consultancy	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
72 nec	Other computer services	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
73	R&D	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
70+71+74	Other business services	Y	Y	Y	Y	Y	Y	P	Y	P	Y	P	Y
75...99	Services nec	Y	Y	N	Y	Y	N	P	N	N	N	P	Y
	Yes	11	10	6	11	11	5	5	9	4	7	5	11
	Partly	0	0	0	0	0	1	3	0	2	0	6	0
	No	0	1	5	0	0	5	3	2	5	4	0	0
	Coverage satisfactory	Y	N	N	Y	Y	N	N	P	Y	Y	Y	Y

NACE/ISIC		Japan	Mexico	Netherlands	N. Zealand	Norway	Portugal	Spain	Sweden	Switzerland	Turkey	U.K	USA
50-52	Wholesale and retail trade												
55	Hotels and restaurants	N	Y	Y	Y	N	N	Y	Y	N	N	Y	Y
60-63	Transport & storage	N	Y	N	Y	N	N	Y	N	N	N	Y	Y
641	Post	P	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y
642	Telecommunications	N	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y
65-67	Financial services	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
70-74	Business services	N	Y	Y	Y	P	Y	Y	N	N	Y	Y	Y
722	Software consultancy	N	P	Y	Y	Y	Y	Y	P	P	P	Y	Y
72 nec	Other computer services	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
73	R&D	N	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
70+71+74	Other business services	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
75...99	Services nec	N	Y	Y	Y	P	Y	Y	N	P	Y	Y	Y
		N	Y	N	Y	N	Y	Y	N	N	N	Y	Y
	Yes												
	Partly	1	9	8	11	6	9	11	4	4	7	11	11
	No	1	1	0	0	1	0	0	0	1	0	0	0
	Coverage satisfactory	9	1	2	0	4	2	0	7	6	4	0	0
		N	Y	N	Y	N	Y	Y	N	N	Y	Y	Y

Source: OECD, replies to 1995 coverage questionnaire; DSTI/EAS Division July 1996.

Table 4. Services as a percentage of BERD 1993, main industries

	R&D	Computer	Transport	Commun.	All other	Total
Norway	23.7	9.9	0.3	2.4	5.5	41.7
New Zealand (91)	7.5	..	1.4	..[a]	26.3	35.2
Greece	4.5	22.7	0.9	0.2	4.4	32.7
Denmark	1.8	6.7	..[b]	3.7	20.3	32.5
Australia	2.7	7.3	..	..	21.7	31.7
Canada	8.8	4.9	0.3	2.8	13.8	30.6
United States	1.8	8.5	..	4.6	11.2	26.1
Portugal	4.8	..	0.5	12.1	3.8	21.2
United Kingdom	9.5	5.3	0.1	3.0	0.3	18.2
Iceland (92)	16.3	..	1.0	..[a]	0.0	17.3
Spain	3.2	3.1	0.3	2.6	6.7	15.9
Finland	2.1	..	..[b]	2.8	7.5	12.3
Ireland	0.6	3.9	0.3	4.8	1.9	11.4
Italy	6.0	2.5	0.1	1.8	0.2	10.7
Netherlands	..	..	..	..	9.8	9.8
Switzerland (92)	5.4	1.9	..	0.0	1.9	9.2
Mexico	4.7	0.0	0.0	0.0	3.1	7.8
Turkey	..	4.9	0.6	1.9	0.0	7.3
France	..	2.6	2.7	..	1.4	6.8
Belgium (91)	..	..	0.0	..	5.8	5.8
Sweden	..	..	..	..	4.4	4.4
Austria (89)	3.9	..	0.0	0.0	0.1	4.0
Germany (91)	1.3	..	0.4	..	0.7	2.4
Japan	..	..	0.2	2.1	0.0	2.3

a. Included in transport.
b. Included in communications.
Source: OECD, DIRDE database, February 1996; DSTI/EAS Division.

Table 5. Services R&D as a percentage of BERD, detailed industries in selected countries

Industry	Norway	New Zealand	Greece	Denmark	Australia	Canada	United States	Portugal
		1991						1992
Service sector	41.7	35.2	32.7	32.5	31.7	30.6	26.1	21.2
Wholesale and retail trade	0.6	..	0.7	5.3	7.3	4.7	..	..
Hotels and restaurants	0.0	..	..	..	..	..	..	..
Transport and storage	0.3	..[a]	0.9	..[a]	..	0.3	..	0.5
Communications	2.4	1.4	0.2	3.7	..	2.8	4.6	12.1
Post	0.0	..	..	..	0.3	..	..	..
Telecommunications	2.4	..	0.2	..	..	..	..	..
Financial intermediation	1.2	..	0.9	..	3.7	6.7	..	..
Real estate, renting and bus. activities	37.2	31.2	29.8	23.6	17.2	16.1	..	8.6
Computer and related activities	9.9	..	22.7	6.7	7.3	4.9	8.5	..
Software consultancy	5.8	..	22.7	..	6.9	..	..	..
Other computer services nec	4.0	..	0.0	..	0.4	..	..	..
R&D	23.7	7.5	4.5	1.8	2.7	8.8	1.8	4.8
Other business activities	3.7	..	2.6	15.0	7.1	2.4	..	3.8
Services nec	0.0	..	0.2	..	0.4	..	..	0.0
BERD	100	100	100	100	100		100	100

Industry	United Kingdom	Iceland	Spain	Finland	Ireland	Italy	Mexico	Turkey
		1992		1994				
Service sector	18.2	17.3	15.9	13.0	11.4	10.7	7.8	7.3
Wholesale and retail trade	0.1	..	0.1	0.3	1.1	0.1	1.5	0.0
Hotels and restaurants	..	..	0.0	..	0.0	..	0.0	0.0
Transport and storage	0.1	1.0	0.3	0.4	0.3	0.1	0.0	0.6
Communications	3.0	..	2.6	2.5	4.8	1.8	0.0	1.9
Post	..	..	0.0	1.9	0.8	..	0.0	0.0
Telecommunications	..	..	2.6	0.6	4.0	..	0.0	1.9
Financial intermediation	..	..	0.0	..	0.5	..	0.0	..
Real estate, renting and bus. activities	14.9	16.3	12.7	9.6	4.7	8.5	4.7	4.9
Computer and related activities	5.3	..	3.1	4.8	3.9	2.5	0.0	4.9
Software consultancy	..	..	2.6	..	3.8	..	0.0	4.8
Other computer services nec	..	..	0.6	..	0.1	..	0.0	0.0
R&D	9.5	16.3	3.2	1.7	0.6	6.0	4.7	..
Other business activities	0.2	..	6.3	3.1	0.3	..	0.0	..
Services nec	0.1	..	0.4	0.2	0.1	0.2	1.6	..
BERD	100	100	100	100	100	100	100	100

Source: OECD, DIRDE database, January 1996 plus additional national sources.

TABLE 6a Information Technology R&D in Japan

	% of firms (a) with IT R&D				% of intramural R&D expenditure (b)			
	1981	1988	1991	1994	1981	1988	1991	1994
Manufacturing	4	6	6	6	5	10	12	12
Machinery	5	7	7	4	6	5	5	7
Motor vehicles	1	3	2	2	0	0	0	1
Other transport equip.	8	13	22	9	1	1	1	1
Electronics and computers	14	15	14	18	9	23	27	23
Electrical machinery	13	10	13	11	18	26	28	29
Instruments	8	11	9	6	5	11	24	28
Printing and publishing	4	42	36	23	10	18	21	19
Other manufacturing	4	5	5	5	1	2	3	2
Agriculture	0	0	0	0	0	0	0	0
Mining	3	4	0	0	0	0	0	0
Construction	8	16	15	11	3	4	6	3
Transp and comms.	24	34	41	35	14	10	14	12
TOTAL	5	7	7	6	5	10	12	12

a) Firms with capital of 100 milllion yen or more
b) Percentage of intramural R&D expenditure of all firms with capital of 100 million yen or more
Source. Japan (95)

Table 6b Information Technology R&D in Italy 1993

	IT R&D	
	% Firms	% R&D exp (a)
Manufacturing	14	..
Machinery	16	24
Motor vehicles	31	10
Other transport equipment	18	18
Office mach & IT equipment	29	68
Electrical and electronic nec	23	28
Instruments	23	34
Other man	7	..
Utilities	67	8
Construction (b)	25	14
Services	40	..
Communications (b)	25	25
Services to business	63	77
Services to households (b)	100	5
R&D centres and associations	21	27
Total	16	33

a) Percentage of total intramural R&D expenditure of firms with IT R&D
b) Based on responses from less than 5 firms.

Source ISTAT(1996)

Table 6c Share of IT related R&D in total intramural expenditures in various industries in Denmark in 1993

Industry	office mach	Comp. services	Sum	telecomm eq	Sum
Agriculture	**0**	**13**	**13**	**0**	**13**
Manufacturing	**2**	**3**	**5**	**9**	**14**
Machinery	1	1	2	0	2
Transp. equip.	0	17	17	0	17
TV and radio	0	0	0	80	80
Telecomms equip.	7	1	8	83	91
Business machines	8	59	67	3	70
Electrical equip.	0	7	7	3	10
Scientific equipment	8	9	17	2	19
other manufa	0	1	1	0	1
Utilities	**2**	**3**	**5**	**0**	**5**
Construction	**0**	**7**	**7**	**0**	**7**
					0
Total services	**0**	**27**	**27**	**10**	**37**
Trade and repairs	0	2	2	42	44
Transport and comm.	0	15	15	23	38
Computer services	1	97	98	0	97
R&D	0	1	1	3	4
Technical services	0	6	6	0	7
Other services	0	71	71	5	76
Technical inst.	1	6	7	1	8
Total	**1**	**11**	**12**	**9**	**22**

Source: Forsknings Ministeriet(1995)

Table 6d Software R&D as percentage of total intramural R&D in selected industries in Canada

	1988	**1991**	**1993**
Manufacturing			
Machinery	6	3	4
Aircraft and parts	5	3	3
Telecomm etc equip.	44	44	47
Business machines	57	71	78
other electrical prods	16	17	13
Scientific equipment	10	24	20
other manufacturing	2	3	3
Total manufacturing	**21**	**23**	**24**
Services			
Transportation etc.	15	28	67
Wholesale and retail		41	50
Finance insurance etc.		79	84
Computer services	71	89	89
Eng. and scient. serv.	19	23	21
Management consult,		54	46
other services		33	30
total services	**31**	**47**	**56**
Other industries	**12**	**7**	**8**
Total	**23**	**28**	**33**

Source: Statistcs Canada (1990 and 1996)

Table 7. Sources of funds for R&D in the services 1993

Percent

	Enterprise	Govt	Other nat.	Abroad	Total
Australia	87.0	3.1	2.4	7.4	100
Austria (89)	29.6	48.8	0.0	21.5	100
Canada (91) [a]	65.0	9.9	..	..	100
Denmark	69.7	13.2	4.0	13.0	100
Finland	86.2	10.0	0.1	3.7	100
France (92)	86.5	9.1	0.1	4.3	100
Germany (91)	61.7	34.5	1.0	1.6	100
Iceland (90)	93.0	3.5	3.5	..	100
Ireland (90)	72.0	2.2	0.0	25.8	100
Italy (91) [a]	36.4	35.1	0.0	2.2	100
Japan	99.7	0.3	0.0	0.0	100
Mexico	88.9	1.6	5.2	4.2	100
Norway	67.9	26.2	0.1	5.8	100
Spain	69.9	21.9	0.2	8.1	100
Sweden (91)	89.6	9.4	0.0	0.9	100
United States	81.7	18.3	..	..	100

a. Detail does not add to total.

Source: OECD, DIRDE database, February 1996; DSTI/EAS Division.

Table 8. Government funded services R&D by industry of performance

	R&D	*Computer*	*Other bus serv..*	Total bus. services	Comms	Transp. and storage	Other	Total
Australia	52.2	16.5	15.2	83.9	0.0	0.0	16.1	100
Austria (89)	97.5	..	2.4	99.9	..	..	0.1	100
Canada (91) [a]	52.1	18.1	12.5	82.6	1.4	2.1	13.9	100
Denmark	3.2	2.1	93.3	98.6	0.6	..	0.8	100
Finland	26.8	..	..	..	0.9	..	..	100
France (92)	0.0	42.1	53.1	95.1	4.9	..	..	100
Germany (91)	74.8	..	..	..	..	18.1	..	100
Italy (91) [a]	80.1	..	..	..	5.1		..	100
Japan	..	..	..	..	43.9	56.1	..	100
Mexico	17.6	..	..	..	..	..	..	100
Norway	88.2	4.0	6.8	98.9	..	..	1.1	100
Spain (92)	58.5	6.4	31.1	95.9	1.9	0.1	..	100
United States	12.2	42.0			22.2	..	..	100

Government funds as a % of total intramural R&D

	R&D	Computer	Other bus.	Total bus. services	Comms	Transp. and storage	Total
Austria (89)	49.1	..	42.9	49.0	..	10.5	48.8
Italy (91) [a]	45.9	..	..	..	11.2	..	35.1
Germany (91)	48.3	..	..	..	..	..	34.5
Norway	40.8	4.4	19.9	29.1	0.0	6.6	26.2
Spain (92)	38.3	9.4	19.9	25.5	3.0	13.5	21.9
United States	33.0	23.5	..	..	22.8	..	18.3
Denmark	7.6	1.4	26.7	18.0	0.7	0.6	13.2
Finland	16.0	..	..	..	0.4	12.8	10.0
Canada (91) [a]	16.2	11.3	14.6	14.6	1.3	4.4	9.9
France (92)	..	10.1	22.1	14.4	..	19.8	9.1
Australia	14.3	1.7	2.4	4.3	..	..	2.5
Mexico	0.5	0.0	0.0	0.5	..	3.4	1.6
Japan	..	..	..	..	0.1	0.0	0.3

Source: OECD, DIRDE database, February 1996; DSTI/EAS Division.

Table 9. Trends in reported R&D expenditure in the services as a percentage of BERD and of value added [1]

	Percentage of BERD				Percentage of value added			
	1981	1985	1991 [2]	1993	1981	1985	1991 [2]	1993
Australia	17.1	..	33.9	31.8	0.11	..	0.43	0.43
Austria [3]	6.1	4.9	4.0	..	0.11	0.09	0.08	..
Belgium	11.6	8.2	5.8	..	0.42	0.33	0.21	..
Canada	9.2	19.9	26.6	30.6	0.16	0.44	0.58	..
Denmark	18.8	23.1	28.5	32.5	0.31	0.46	0.77	0.92
Finland	3.9	12.4	12.8	12.3	0.08	0.36	0.57	0.44
France	2.4	2.5	4.2	6.8 [2]	0.07	0.08	0.15	0.24
Germany	1.5	1.9	2.4	..	0.09	0.14	0.17	..
Greece [4]	5.7	12.4	39.4	32.7	0.01	0.06	0.16	0.19
Iceland [5]	0.0	7.9	18.3	17.3	0.00	0.03	0.15	..
Ireland	3.6	3.1	3.4	11.4	0.00	0.00	0.10	..
Italy	7.1	5.9	9.0	11.2	0.12	0.13	0.24	0.25
Japan	3.1	3.3	2.1	2.3	0.12	0.17	0.13	0.13
Mexico	..	..	..	7.8	..	..	..	0.00
Netherlands	6.0	5.3	6.7	9.8	0.17	0.17	0.17	0.23
New Zealand	..	..	35.2	..	..	..	0.20	..
Norway	38.8	39.2	41.8	41.7	0.83	1.34	1.19	..
Portugal [6]	9.7	21.0	27.2	21.2	0.03	0.07	0.11	..
Spain	7.9	9.9	16.4	15.9	..	0.07	0.18	..
Sweden	5.6	2.5	3.7	4.4	0.26	0.15	0.20	0.28
Switzerland [5]	1.9	..	..	9.2	..	..	..	0.43
Turkey	..	..	4.5	7.3	..	..	0.02	0.02
United Kingdom	1.3	5.2	16.5	18.2	0.06	0.21	0.59	0.64
United States	3.7	8.0	24.1	26.1	0.14	..	0.99	0.96

1. Coverage varies between countries.
2. Some growth may be due to wider survey coverage or the transfer of units from other sectors.
3. 1984 and 1989.
4. 1986 instead of 1985.
5. 1992 instead of 1993.
6. 1982, 1986, 1990 and 1992.

Source: OECD, DIRDE and STAN databases, February 1996.DSTI/EASD

Table 10. R&D in the computer and computer services industries as a percentage of BERD, selected years

	1981	1985	1989			1991			1993		
	Hardware	Hardware	Hardware	Comp serv.	Sum	Hardware	Comp serv.	Sum	Hardware	Comp serv.	Sum
Australia	7.9	..	..	..	..	..	7.6	..	0.9	7.3	8.2
Austria	8.3	..	5.9	..	..	..	..	..	..	..	..
Belgium	0.0	0.0	..	..	..	..	..	..	..	..	..
Canada	4.0	5.3	6.1	4.4	10.5	6.1	4.2	10.3	5.3	4.9	10.2
Denmark	4.1	3.1	2.8	3.3	6.1	1.5	4.1	5.6	1.2	6.7	7.9
Finland	3.3	..	0.6	..	..	..	..	..	..	..	..
France	4.6	5.0	3.8	..	..	3.5	..	..	3.2	2.6	5.8
Germany	2.4	2.5	3.3	..	..	4.8	..	..	..	..	..
Greece	..	..	7.6	14.1	21.7	11.4	23.0	34.4	15.0	22.7	37.7
Iceland	0.0	1.5	..	..	..	..	..	..	..	..	..
Ireland	5.1	8.1	9.4	..	..	9.6	..	..	8.5	3.9	12.3
Italy	6.4	7.3	6.1	1.4	7.5	6.1	1.8	7.9	5.4	2.5	7.9
Japan	3.8	5.8	9.9	..	..	9.6	..	..	8.9	..	..
Netherlands	0.8	1.2	3.3	..	..	4.1	..	..	4.1	..	..
New Zealand	..	..	1.1	..	..	0.1	..	..	..	..	..
Norway	3.3	4.5	6.2	..	..	1.6	5.4	7.1	0.6	9.9	10.4
Portugal	..	..	..	..	..	..	..	..	..	..	..
Spain	2.4	6.5	5.8	0.9	6.7	5.9	1.5	7.4	2.6	3.1	5.8
Sweden	..	6.0	3.5	..	..	3.3	..	..	3.3	..	..
Switzerland	0.3	..	..	..	..	..	..	..	..	1.9	..
Turkey	..	..	..	..	..	0.0	0.0	0.0	0.1	4.9	4.9
United Kingdom	4.6	7.0	6.5	5.3	11.8	4.8	5.2	10.1	4.5	5.3	9.8
United States	8.5	11.7	11.4	3.7	15.1	9.6	4.1	13.7	4.1	8.5	12.6
Mexico	..	..	..	..	..	..	..	..	3.6	0.0	3.6

Source: OECD, DIRDE and ANBERD databases, February 1996; DSTI/EAS Division.

Table 11. Contribution of the services to growth in BERD

	1981-85 [a]			1985-89 [a]			1989-93 [a]		
	BERD	services	serv %	BERD	services	serv %	BERD	services	serv %
Australia	45.7	7.8	17.1	85.8	56.5	65.9	41.9	6.0	14.3
Belgium	..	..	..	..	..	..	..	..	..
Canada	41.9	19.1	45.6	13.0	8.0	61.5	9.8	4.4	44.9
Denmark	45.9	15.0	32.7	30.5	9.3	30.5	29.3	17.3	59.0
Finland	60.3	16.0	26.5	43.5	11.1	25.5	1.4	-3.9	-278.6
France	21.2	6.0	28.3	20.3	2.0	9.9	11.0	11.0	100.0
Germany	23.1	0.9	3.9	16.4	0.5	3.0	4.6	0.4	8.7
Greece	..	..	..	..	..	..	..	..	..
Iceland	100.8	15.9	15.8	100.1	8.5	8.5	46.6	17.1	36.7
Ireland	47.4	9.0	19.0	40.3	2.0	5.0	43.0	1.2	2.8
Italy	38.8	1.0	2.6	29.1	3.6	12.4	1.3	3.4	261.5
Japan	52.8	1.9	3.6	33.2	0.6	1.8	3.1	-0.6	-19.4
Mexico	..	..	..	..	..	..	..	..	..
Netherlands	24.1	0.6	2.5	21.5	1.0	4.7	-13.7	3.2	-23.4
New Zealand	..	..	..	..	..	..	..	..	..
Norway	72.5	28.8	39.7	0.1	-2.9	-2900.0	4.9	7.0	142.9
Spain	69.2	8.9	12.9	67.5	14.9	22.1	8.8	2.5	28.4
Sweden	46.7	-2.0	-4.3	8.4	1.9	22.6	16.0	1.2	7.5
Switzerland	..	..	..	..	..	..	..	..	..
Turkey	..	..	..	..	..	..	..	..	..
United Kingdom	23.1	1.2	5.2	21.4	15.3	71.5	-3.0	8.0	-266.7
United States	37.1	7.3	19.7	5.8	6.5	112.1	3.0	13.3	443.3

a. Or nearest time period available.
Source: OECD, DIRDE database, February 1996; DSTI/EAS Division.

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